

III-V COMPOUND SEMICONDUCTOR AND ITS MANUFACTURE AND LIGHT EMITTING DEVICE

Patent Number: JP9116130
Publication date: 1997-05-02
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Requested Patent: JP 19960015228
Application Number: JP19960015228 19960131
Priority Number(s):
IPC Classification: H01L29/43; H01L21/205; H01L21/28; H01L33/00
EC Classification:
Equivalents: JP3064891B2

Abstract

PROBLEM TO BE SOLVED: To provide a III-V compound semiconductor with very few defects and high quality and its manufacturing method and, further, a light emitting device consisting of the compound semiconductor.

SOLUTION: After trimethyl Ga and NH₃ are supplied onto the mirror-polished C surface of a sapphire substrate 9 at a substrate temperature of 550 deg.C and a GaN buffer layer 8 is formed, the substrate temperature is elevated to 1100 deg.C and silane is supplied to build up an Si-doped n-type GaN layer 5 and, further, nondoped GaN layer 4 is formed at the same temperature. Then the substrate temperature is lowered to 780 deg.C and an In_{0.3}Ga_{0.7}N light emitting layer 1 is built up by using TEG, TMI and NH₃. Further, after TEG, TEA and NH₃ are supplied at the same temperature and a Ga_{0.8}Al_{0.2}N protective layer 2 is formed, the substrate temperature is elevated to 1100 deg.C and an Mg-doped GaN layer 3 is built up. After the III-V compound semiconductor is taken out from a furnace and subjected to a heat treatment in an N₂ atmosphere and the GaN layer 3 is converted into a low resistance p-type layer, positive and negative side electrodes 6 and 7 are formed to obtain a light emitting device emitting clear blue light.

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L12 ANSWER 1 OF 1 WPIDS (C) 2002 THOMSON DERWENT

AN 1996-363747 [37] WPIDS

DNN N1996-306658 DNC C1996-114639

TI Layered III-V semiconductor structure with high quality and low defect content, esp. for UV or blue light emitting element.

DC L03 U11 U12 V08

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CYC 4

PI DE 19603782 A1 19960808 (199637)* 12p

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JP 09116130 A 19970502 (199728) 9p <--

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ADT DE 19603782 A1 DE 1996-19603782 19960202; JP 09036425 A JP 1995-178725 19950714; JP 09116130 A JP 1996-15228 19960131; TW 351020 A TW

1996-101006

19960127; US 6346720 B1 US 1996-590574 19960124; US 2002053680 A1 Div ex

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PRAI JP 1995-205954 19950811; JP 1995-16651 19950203; JP 1995-78671

19950404; JP 1995-178725 19950714

AN 1996-363747 [37] WPIDS

AB DE 19603782 A UPAB: 19970716

A new III-V semiconductor structure comprises a stacked layer sequence of

(a) a 5-90 Angstroms thick first layer of a III-V semiconductor of formula $\text{In}_x\text{Ga}_y\text{Al}_z\text{N}$ ($x+y+z=1$, $x, y = 0$ to 6 exclusive; and $z = 0$ to less than 1);

(b) a second layer of a III-V semiconductor of formula $\text{Ga}_x\text{Al}_y\text{N}$ ($x'+y'=1$, $x' = \text{greater than } 0 \text{ to } 1$; $y' = 0 \text{ to less than } 1$); and (c) a third layer of a

III-V semiconductor of formula $\text{Ga}_{x''}\text{Al}_{y''}\text{N}$ ($x''+y''=1$; $x'' = \text{greater than } 0 \text{ to } 1$; $y'' = 0 \text{ to less than } 1$). Also claimed are III-V semiconductor

structures comprising a fifth III-V semiconductor layer and the first, fourth and fifth III-V semiconductor layers and the first layer, and the

fourth and fifth layers and the first, second and third layers. Further

claimed are (i) a process for prodn. of a III-V semiconductor structure;

and (ii) a light emitting element with a III-V semiconductor structure as described above.

USE - Used e.g. for UV or blue-emitting LEDs and laser diodes.

ADVANTAGE - The structure has high quality and few defects and allows prodn. of light emitting elements having excellent emission properties.

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